

# Integrated Programme in Materials Science

## Sample Questions

The written examination consists of 50 questions in Chemistry, Physics, and Mathematics at the B.Sc. level. The duration of the examination is 150 minutes.

The question paper is likely to have a mix of both objective and non-objective type questions. There will be 20 questions each in Physics and Chemistry and 10 in Mathematics.

Sample of questions is given below.

1. If  $A$  is the Helmholtz free energy, and  $P$ ,  $V$  denote pressure and volume respectively, which of the following is true?

(a)

$$\left(\frac{\partial A}{\partial V}\right)_T = -P$$

(b)

$$\left(\frac{\partial A}{\partial V}\right)_T = P$$

(c)

$$\left(\frac{\partial A}{\partial T}\right)_V = -P$$

(d) none of the above

2.  $\int_{-\infty}^{\infty} e^{-x^2} dx =$

(a) 0

(b)  $\sqrt{\pi}$

(c)  $\frac{\sqrt{\pi}}{4}$

(d)  $\frac{\sqrt{\pi}}{2}$

3. Consider the following reaction,



This reaction is an example of:

- (a) First order nucleophilic substitution,  $\text{S}_{\text{N}}1$
- (b) First order elimination, E1
- (c) Second order nucleophilic substitution,  $\text{S}_{\text{N}}2$
- (d) Second order elimination, E2

4. Select the correct order of shapes of the following compounds:

- (i)  $\text{PbCl}_4$ ; (ii)  $\text{SbF}_6^-$ ; (iii)  $\text{BH}_4^-$ ; (iv)  $\text{PCl}_3$
- (a) i- tetrahedral; ii-octahedral; iii- tetrahedral; iv-pyramidal
- (b) i- octahedral; ii-octahedral; iii- tetrahedral; iv-square planar
- (c) i- square planar; ii-octahedral; iii- tetrahedral; iv-tetrahedral
- (d) i- tetrahedral; ii-octahedral; iii- octahedral; iv-pyramidal

5. In intrinsic germanium at room temperature, the number of

- (a) Electrons are more than holes
- (b) Holes are more than electrons
- (c) Electrons and holes are equal
- (d) There are no electrons and holes